MULTIMEDIA UNIVERSITY

STUDENT ID NO

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# MULTIMEDIA UNIVERSITY

# FINAL EXAMINATION

**TRIMESTER 2, 2019/2020**

## PPS0034 – INTRODUCTION TO PROBABILITY AND STATISTICS

(Foundation in Business)

13 MARCH 2020
3.00 p.m. – 5.00 p.m.
(2 Hours)

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**INSTRUCTIONS TO STUDENT**

1. This question paper consists of 4 pages with **FOUR** questions.

2. Attempt **ALL** four questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the answer booklet provided. All necessary workings **MUST** be shown.

4. **Formulae** are provided at the back of the question paper.

5. **Statistical table** is provided.

## QUESTION 1

a) Let $X$ be the discrete random variable with the following probability distribution.

| $X$ | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| $P(X=x)$ | $\frac{1}{64}$ | $\frac{9}{64}$ | $m$ | $m$ |

i) Find the value of $m$. (3 marks)

ii) Find the expected value and standard deviation for the random variable $X$.

(7 marks)

b) The continuous random variable $Y$ has the following probability density function:

$$f(y)=\begin{cases}\frac{1}{2}y & ; \quad 0\le y<1\\ ky^3 & ; \quad 1\le y\le 2\\ 0 & ; \quad \text{otherwise}\end{cases}$$

i) Show that $k=\frac{1}{5}$. (5 marks)

ii) Find the mean and variance for the random variable $Y$. (10 marks)

**(Total 25 marks)**

## QUESTION 2

a) Hospital records show that of patients suffering from a certain disease, 74% die of it. What is the probability that of 16 randomly selected patients,

i) 9 will recover? (3 marks)

ii) between 5 and 14 will not recover? (4 marks)

iii) at most 10 will not recover? (3 marks)

b) A 5-litre bucket of water is taken from a swamp. The water contains 100 mosquito larvae. A 200 ml flask of water is taken form the bucket for further analysis. What is

i) the expected number of larvae in the flask? (3 marks)

ii) the probability that the flask contains not less than 8 mosquito lava? (3 marks)

c) Carrots entering a processing factory have an average length of 15.3 cm, and standard deviation of 5.4 cm. If the lengths are approximately normally distributed,

i) what is the maximum length of the lowest 10% of the load? (4 marks)
(Leave your answer in 4 decimal places.)

ii) what is the probability that the length is between 14.8 cm and 15.6 cm? (5 marks)

**(Total 25 marks)**

**Continued...**

## QUESTION 3

a) Consider the following data on the prices for the hard cover photobooks available on the website for a major seller.

RM89.90 RM129.90 RM109.90 RM129.90 RM109.90 RM89.90

i) List all the possible samples of size five (without replacement) from this population and construct the sampling distribution of the sample mean. Then, find the sampling error for each sample. (15 marks)

ii) If a random sample of 5 prices: 89.90, 129.90, 129.90, 109.90, 89.90 was mistakenly recorded as 89.90, 129.90, 119.90, 109.90, 89.90, calculate the non-sampling error. (3 marks)

b) The mean amount of cholesterol in eggs labeled "large" is 188 milligrams, with a standard deviation of 79 milligrams. Find the probability that the mean amount of cholesterol in a sample of 147 eggs will be within 3 milligrams of the population mean. (7 marks)

**(Total 25 marks)**

## QUESTION 4

a) The weights, in kg of a random sample of students are as follows:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 63 | 63 | 64 | 64 | 64 | 63 | 69 | 70 | 66 |
| 60 | 59 | 70 | 67 | 68 | 71 | 58 | 60 | 66 |
| 65 | 63 | 68 | 65 | 62 | 63 | 66 | 69 | 64 |
| 59 | 62 | 67 | 62 | 65 | 64 | 72 | 70 | 63 |
| 62 | 63 | 61 | 66 | 65 | 63 | 71 | 68 | 65 |
| 64 | 62 | 60 | 63 | 64 | 65 | 59 | 67 | 65 |

Assume that the population variance is 11.0593 kg.

Test the hypothesis that the mean weight in the population is 62 kg at a 0.2% significance level. (10 marks)

b) The board of a major credit card company requires that the mean wait time for customers for service calls is at most 3.10 minutes. To make sure that the mean wait time is not exceeding the requirement, an assignment manager tracks the wait times of 48 randomly selected calls. The mean wait time was calculated to be 3.7 minutes. Assuming the population standard deviation is 1.47 minutes, is there sufficient evidence to support the requirement at the 0.03 significance level? (9 marks)

**Continued...**

c) A faculty advocacy group is concerned about the amount of time teachers spend each week doing school work at home. A simple random sample of 54 teachers had a mean of 8.3 hours per week working at home after school. Construct a 96% confidence interval for the mean number of hours per week a teacher spends working at home. Assume that the population standard deviation is 1.8 hours per week.

(6 marks)

**(Total 25 marks)**

**Continued...**

**Formulae:**

**1.**

| | Mean | Variance |
|---|---|---|
| **Discrete Random Variable $X$** | $\mu = E(X)$ $= \sum xP(x)$ | $Var(X) = E(X^2) - [E(X)]^2$ **where** $E(X^2) = \sum x^2 P(x)$ |
| **Continuous Random Variable $X$** | $\mu = E(X)$ $= \int_{-\infty}^{\infty} xf(x)dx$ | $Var(X) = E(X^2) - [E(X)]^2$ **where** $E(X^2) = \int_{-\infty}^{\infty} x^2 f(x)dx$ |

**2.**

| | Formula | Mean | Standard Deviation |
|---|---|---|---|
| **Binomial Probability** | $P(x) = \binom{n}{x} p^x q^{n-x}$ | $\mu = np$ | $\sigma = \sqrt{npq}$ |
| **Poisson Probability** | $P(x) = \frac{e^{-\lambda}\lambda^x}{x!}$ | $\mu = \lambda$ | $\sigma = \sqrt{\lambda}$ |

**3.** The $z$ value for a value of $x$: $z = \frac{x - \mu}{\sigma}$

**4.** The $z$ value for a value of $\bar{x}$ : $z = \frac{\bar{x} - \mu_{\bar{x}}}{\sigma_{\bar{x}}}$

where $\mu_{\bar{x}} = \mu$ and $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$

**5.** Sampling error = $\bar{x} - \mu$

Non-sampling error = incorrect $\bar{x}$ − correct $\bar{x}$

**6.** Point estimate of $\mu = \bar{x}$

Margin of error = $\pm 1.96\sigma_{\bar{x}} = \pm 1.96\frac{\sigma}{\sqrt{n}}$ or $= \pm 1.96 s_{\bar{x}} = \pm 1.96\frac{s}{\sqrt{n}}$

**7.** The $(1-\alpha)100\%$ confidence interval for $\mu$ is

$\bar{x} \pm z\sigma_{\bar{x}}$ if $\sigma$ is known

$\bar{x} \pm z s_{\bar{x}}$ if $\sigma$ is not known

where $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$ & $s_{\bar{x}} = \frac{s}{\sqrt{n}}$

**End of Paper**